8-1-2002

The Effect Of Regular Exercise On The Incidence Of Depression In College Students

Arlene Jones

THE RELATIONSHIP BETWEEN URINARY TRACT INFECTIONS AND MENTAL STATUS CHANGES IN ELDERS

by

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A Thesis
Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Nursing
in the Division of Nursing
Mississippi University for Women

COLUMBUS, MISSISSIPPI

August 2002

The Relationship Between Urinary Tract Infections and Mental Status Changes in Elders

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Abstract

The purpose of this study was to determine whether there is a relationship between urinary tract infections and acute mental status changes among elderly patients with a urinary tract infection in a geriatric-psychiatric unit. The Neuman Systems Model provided the theoretical framework. The null hypothesis was as follows: There will be no statistically significant difference in the mental status of elders with a urinary tract infection and elders without a urinary tract infection. A descriptive, retrospective chart review was performed by the researcher to collect the appropriate data. Convenience sampling was utilized, and the sample consisted of 100 patients' charts: 50 patients' charts with a urinary tract infection and results of the mini-mental status exam (MMSE) on the chart, and 50 patients' charts without a urinary tract infection and results of the MMSE on the chart. The range of ages for the patients in Group 1 (without a urinary tract infection) was 60 to 89 years with a mean age of 75.08. The range of ages for the patients in Group 2 (with a urinary tract infection) was 56 to 95 years with

a mean age of 77.7. Analysis of the MMSE in Group 1 yielded a range from 0 to 26 with a mean score of 21.3 (SD = 4.54). Analysis of the MMSE in Group 2 yielded a range from 0 to 30 with a mean score of 17.3 (SD = 6.80). A t test was used to report differences in the scores of the MMSE. Findings revealed a significant change in the scores on the MMSE in elders who had a urinary tract infection compared to the MMSE scores of elders who did not have a urinary tract infection ($p < .001$). Therefore, the researcher failed to accept the null hypothesis. The following recommendations were suggested for future research: (a) replication of a similar study with a larger sample in various geographic locations and ethnic cultures to evaluate the effects of a urinary tract infection on mental status, (b) implementation of a longitudinal study with a larger sample in various geographic locations and ethnic cultures which includes treatment for a urinary tract infection with a MMSE performed before and after treatment, (c) replication of the study utilizing groups of participants who are more homogenous in age, and (d) replication of a similar study which utilizes controls for comorbidity and medication regimens.

Acknowledgments

First, my entire educational endeavor would not have been possible without the assistance of my friend and Savior, Jesus Christ. When I was down, he lifted me. When I steered from the path, he set me straight. When I thought I could not go on, he carried me. Simply said, without the love and grace of Jesus Christ, I would not have prevailed in the attainment of my degree. A wholehearted thanks to Jesus Christ for His guidance, strength, and love.

It is with heartfelt thanks and deepest gratitude that I acknowledge those persons who, through their support, assistance, and sacrifices, made my research and educational endeavors possible. The completion of this study would not have been possible without their help.

First, I would like to express my appreciation and respect to my committee members, Dr. Patsy Smyth, Lorraine Hamm, and Dr. Linda Cox, for their guidance and instruction in all aspects of this project. In addition, I wish to extend a very special thanks to Dr. Mary Pat

Curtis for her expertise, her professionalism, and particularly for her wonderful sense of humor which lifted me during the stressful times and rekindled my desire to succeed.

To my advisor, Dr. Patsy Smyth, I say thanks, for her patience, guidance, and mentorship during this study.

To Ms. Hamm, I say thanks for her insight and her caring spirit during this study.

Thanks is expressed for the assistance provided by Mary Lillian Randle, librarian at North Mississippi Medical Center.

The writer also wishes to thank Dr. Dianne Sloan of the Associate Nursing Department, Northeast Mississippi Community College, for her assistance, encouragement, and friendship during my educational endeavors.

Appreciation is further expressed to Mrs. Phyllis McCorkle for her time and patience in the typing of this thesis.

Next, I would like to extend a very special thanks to my entire family. To my loving wife, Betty, words cannot express the love I feel for you, for your encouragement,

your support, your sacrifices, and most of all, your belief in me and my abilities. For this, I am eternally grateful.

To my granddaughters, Nicole, Shea, Ashley, Amber, and Holly, whom I love with all my heart. A sincere thanks to all of you for understanding when I was busy with school work and unable to participate in your activities. Your sacrifices and understanding will not go unrewarded. My deepest love to all of you.

To my stepchildren, Lonnie, Sonia, and Jonathan, my love and thanks to you all for your understanding during this trying time.

To my mother, Jane Carter, a special place is reserved in my heart for you and the love and understanding that only a mother can show.

To my father, J. T., who has always been there for me, even before my educational endeavors, I send my sincerest love.

To my sisters, Rhonda, Sharlet, Jamie, and their families, my warmest regards and love for their support and encouragement during my educational endeavors.

Lastly, but certainly not least, a special thanks to all of my classmates for their continued support throughout this year.

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Chapter I

The Research Problem

Mental status changes in the elderly population have traditionally believed to be a normal part of the aging process. However, all facets of mental status changes cannot be attributed to the aging process. Research has demonstrated that other variables may be responsible for confusion in elders. For instance, some elders are unable to metabolize drugs effectively, making them particularly sensitive to the side effects of the medication and possibly resulting in toxicity and acute mental status changes (McCartney, 1999). In addition, researchers have demonstrated that acute mental status changes in elders may actually be an indicator for pneumonia (Boyles, 1998).

Walker, McGreer, Armstrong-Evans, and Loeb (2000) suggested a link between urinary tract infection and mental status changes. However, review of literature revealed that minimal research has been conducted on the relationship between infection, including urinary tract infection, and acute mental status changes. Previous studies related to mental status changes and infections were largely conducted utilizing only nursing homes. In

addition, most of the studies were dated and contained no application for primary care. With the elderly population growing at a rapid rate, the economic impact on patients who would require increased health care expenditures due to complicated urinary tract infections would be significant. It is imperative that research be completed to explore a possible relationship between mental status changes and urinary tract infections. Therefore, the purpose of this study was to determine whether there is a relationship between urinary tract infections and acute mental status changes among elderly patients with a urinary tract infection and acute mental status changes versus elderly patients without acute mental status changes in a geriatric-psychiatric unit.

Establishment of the Problem

The population of persons 65 years of age or older is 13%, with an anticipated increase to 20% by the year 2030 (Desai, Zhang, & Hennessy, 1999). Currently, 19.8% of adults age 55 years and over suffer from some form of mental status decline with 6.6% of this population suffering severe cognitive impairment (National Institute of Mental Health [NIMH], 1999). According to the National Institute of Health (NIH) (2001), mental illness accounts for over 15% of the burden of disease in established

market economies. This amount is more than the disease burden caused by all cancers. With current trends, this number is expected to increase to 22.5% by the year 2020 (NIH, 2001). The prevalence of the population diagnosed with a decline in mental status changes as well as the effects of mental status changes on the economy signifies the importance of appropriate diagnosis and treatment by health care personnel. With supportive data from additional research, the health care industry will be better able to understand, diagnose, and treat mental status changes. According to Cummings and Benson (1992), the rapidly increasing rate of patients with mental status changes is approaching an epidemic. The authors further stated that the actual prevalence of mental status changes has been difficult to determine due to the unreported number of patients remaining at home. According to Cummings and Benson (1992),

> In 1950, 8 percent of the population of the United States was over 65 years, accounting for 12.3 million people. . . . It is estimated that by the year 2030 those over age 65 will constitute between 17 and 20 percent of the population. (p. 4)

These researchers further stated that the cost of caring for patients who displayed a decline in mental status had risen from $12 billion annually to the current $30 billion annually. As many as 50% of patients in high

care or nursing homes, according to the National Aging Research Institute (1995), display mental status changes.

Researchers have determined that elderly patients sometimes present with atypical symptoms of a urinary tract infection, such as acute mental status changes, rather than the typical symptoms of urgency, frequency, and dysuria. Further, researchers have indicated that the rate of positive urine cultures increased twofold in patients with mental status changes compared to those without mental status changes (Boscia et al., 1986). However, no studies have explored a correlation between urinary tract infection and mental status changes in the elderly. The current researcher examined whether there is a relationship between mental status changes and urinary tract infections in elders.

Significance to Nursing

Research conducted on urinary tract infections and mental status changes in elders may indicate change for the treatment of mental status changes by nurse practitioners. With further research, if a link between these variables is suggested, nurse practitioners can more accurately assess, diagnose, and promptly treat mental status changes in the elder. By performing scientific research, health care workers can establish guidelines for

evaluation and treatment when mental status changes stimulated by a urinary tract infection or other infection are suspected. Nurse practitioners in primary care practice are in a prime position to recognize urinary tract infections and the possible link with mental confusion in elders before costly psychiatric hospitalizations occur. Findings from this study may also serve to advance the establishment of the Neuman Systems Model as an appropriate theory for assessing elders. With the number of elders rapidly increasing, conceptual models for research and practice are profoundly needed.

Theoretical Framework

The framework used to guide this research was the Neuman Systems Model. All persons are dynamic creatures composed of physiological, psychological, sociocultural, developmental, and spiritual components according to the Neuman Systems Model (Neuman, 1995). In the Neuman Systems Model a person is considered to be in an open system in constant interaction with the environment and is, therefore, affected by both external and internal factors which can cause stress. By successfully coping with these external and internal stressors, the patient is able to maintain a state of health, harmony, and personal integrity.

According to Neuman (1995), the person is identified as an individual, family, group, community, or social issue. Neuman defines the client system as a composite of interrelationships of physiological, sociocultural, developmental, and spiritual factors. The client system is considered an open system that reacts with the environment. The environment is defined as all of the internal and external factors that surround or interact with the client. Neuman identified three aspects of the environment: internal, external, and created. Internal environment is intrapersonal or within the client. A urinary tract infection is part of the client's internal environment since it occurs within the client. Based on this model, mental status changes are also primary internal changes.

Therefore, successful coping with internal factors, such as urinary tract infections, would be instrumental in preventing complications of urinary tract infections, such as acute mental status changes, which could lead to further deterioration of the individual's health status. Neuman visualized the client system protected by a series of concentric buffers that serve to minimize the impact of stressors and act as safety zones between environments and the central core (Reed, 1993). According to Neuman, an individual's normal line of defense is the model's outer

solid circle and represents a state of stability for the individual. This solid outer circle is surrounded by a flexible line of defense which serves as a protective buffer for preventing stressors from breaking through the solid line of defense. Inside the normal line of defense and the flexible lines of defense are a series of broken rings surrounding the core structure called lines of resistance. These rings represent resource factors, such as the body's immune system, which help an individual to defend off stressors. When invaded by stressors, such as a urinary tract infection or mental status changes, an individual's degree of resistance to the stressor is determined by the stability or instability of these lines of defense (Neuman, 1995).

The Neuman Systems Model is a wellness model that defines health as a continuum of wellness to illness that is constantly changing. System stability and optimal wellness are indicators that the organism's needs are met. However, a decreased mental status indicates that the organism's needs are not being met. Individuals who present with a urinary tract infection and a decrease in mental status are at a reduced state of wellness.

Neuman believed adequate health attainment and personal integrity are related to successful coping with external and internal stressors, such as urinary tract

infections. In addition, nurses should consider all aspects of a person's health, such as psychological, spiritual, sociocultural, and developmental. According to the Neuman Systems Model, nurse practitioners should address an individual's psychological health in addition to physical health in order to achieve better health care outcomes for the patient. Thus, when treating patients with urinary tract infection, nurse practitioners must also evaluate the individual's psychological status in order to produce better health care outcomes and prevent deterioration of the patient's mental status. Research utilizing a descriptive study on the relationship between urinary tract infections and mental status changes in elders can provide practitioners with valuable information to more effectively evaluate the impact of urinary tract infection on the defense systems of elders vulnerable to these problems (Neuman, 1995).

Assumptions

The assumptions upon which this study was based are listed below:

1. Laboratory personnel performed the urinalysis and culture and sensitivity correctly.

2. The psychologist who performed the Mini-Mental Status Exam (MMSE) performed and scored it correctly.

3. A urinary tract infection is a potential stressor which can impact a client's lines of defense.

4. MMSE is an accurate measurement of mental status in elders.

Purpose of the Study

The purpose of this study was to determine whether there is a relationship between urinary tract infections and acute mental status changes among elderly patients with acute mental status changes versus elderly patients without acute mental status changes in a geriatric-psychiatric unit.

Statement of the Problem

The relationship between mental status and urinary tract infections in elders has not been empirically documented in the literature. Many elderly patients who have bacteriuria on urinalysis and display acute mental status changes as the only symptoms are not being treated for their urinary tract infections, but are being prescribed psychiatric medications. Some researchers (Walker et al., 2000) cited confusion as one of the symptoms of a urinary tract infection; however, no studies were identified that document a relationship between existing urinary tract infections and the mental status in elderly patients. Research needs to be performed to

determine if there is a relationship between mental status and urinary tract infections in elders so primary care providers can provide appropriate treatment prior to referral to a psychiatrist.

Research Hypothesis

One null hypothesis was used to guide the study. That hypothesis was as follows: There will be no statistically significant difference in the mental status of elders with a urinary tract infection and elders without a urinary tract infection.

Definition of Terms

The major terms used in this study are defined as follows:

1. *Mental status*

Theoretical: the total emotional and intellectual response of an individual to external reality.

Operational: cognitive state as measured by the score on the Mini-Mental Status Exam with a score of < 23 indicating a decreased cognitive status.

2. *Elders*

Theoretical: persons 65 years of age or older.

Operational: patients 65 years of age or older who were in a geriatric psychiatric unit of a hospital in the southeastern United States.

3. *Urinary tract infection*

Theoretical: illness caused by microorganisms affecting those structures of the body which participate in the secretion and elimination of urine.

Operational: positive urine culture with > 30,000 colonies of bacteria detected or at least two out of the following criteria on urinalysis: nitrates +, leucocytes $\geq$ 2, or bacteria $\geq$ 2.

Summary

In this chapter the problem was identified as a lack of empirically based research to support a relationship between urinary tract infections and mental status changes in elders. The significance to nursing was explored, and the researcher asserted that if a statistically significant correlation was discovered, nurse practitioners could more accurately assess, diagnose, and promptly treat mental status changes in the elder. According to the Neuman Systems Model, the stressor is the urinary tract infection and has the potential of penetrating a person's lines of defense, thereby causing an alteration in the mental health status. Successful coping in persons with internal factors, such as urinary tract infections, would be instrumental in preventing complications of urinary tract infections such as acute

mental status changes, which could lead to further deterioration of the individuals health status. Assumptions which are pertinent to the study were identified. An hypothesis was constructed, and the terms pertinent to the study were defined.

Chapter II

Review of the Literature

The review of literature strongly established the need for further research on mental status changes and urinary tract infections in elders. Numerous researchers documented acute mental status changes as being present in a high percentage of patients diagnosed with urinary tract infection, yet no studies have documented empirical evidence of a relationship between urinary tract infections and mental status changes in elders. Additionally, studies have utilized only long-term care facilities as the setting for research with no application to practice.

Walker, McGreer, Simor, Armstrong-Evans, and Loeb (2000), in a qualitative study of doctors and nurses, described issues associated with treating elders with possible urinary tract infections in a long-term care setting. Data were collected utilizing focused group interviews over a one-month period. A total of four interviews with two of the focus group interviews being held with nurses and the other two being held with

doctors. Each focus group interview lasted approximately one and one half hours and included a short definition of the problem.

Asymptomatic bacteriuria was defined as, ". . . the presence of bacteria in urine without urinary symptoms" (Walker et al., 2000, p. 273). The researcher further stated that asymptomatic bacteriuria is common in institutionalized elderly people and prevalence increases with age. According to Walker et al. (2000), the prevalence of bacteriuria was as high as 50% in elderly institutionalized females and 35% in elderly institutionalized males. In randomized trials there were no differences in morbidity or mortality between treated and untreated residents. Despite these findings, the authors stated that institutionalized elderly people are still being treated inappropriately with antibiotics for asymptomatic bacteriuria (Walker et al., 2000).

Walker et al. indicated that the research was hypothesis generating; therefore, it would provide subjective data that facilitated ideas for possible interventions. The study consisted of 22 physicians and 16 nurses who provided care to long-term care residents. Focus groups were conducted with physicians in one group and nurses in the other. The focus groups were recorded and later analyzed for emerging issues and themes. The

discussions were held over a one-month period with two of the discussions being with the physicians and the other two discussions being with the nurses (Walker et al., 2000). For the purpose of the study, "Open-ended questions were used to generate discussion in three main areas: the decision to order a urine culture, the decision to order antibiotics and possible strategies to reduce the prescription of antibiotics for asymptomatic bacteriuria" (Walker et al., 2000, p. 274).

The decision to order a urine culture was based on subtle changes in the patients according to the physicians and nurses. Both groups were in agreement that because of the cognitive changes in the elderly sometimes the typical symptoms of urinary tract infection were not present (Walker et al., 2000). They further stated that the patient might appear more ". . . restless or confused, more irritable, crying, aggressive, agitated and less compliant" (Walker et al., 2000, p. 274). The physicians reported that the nurses spent more time with the patients, knew the patients better than they, and followed their leads in relation to a suspected urinary tract infection. Participants further stated that the changes related to urinary tract infections were sometimes subtle and the nurses were the first to notice.

The researchers discovered that many residents in long-term care were cognitively impaired and unable to voice their symptoms. The researchers further stated that the physicians and nurses described subtle indicators, such as an increase in confusion, irritability, and subtle personality changes, as possible signs of a urinary tract infection (Walker et al., 2000). However, ". . . an association between these nonspecific signs and symptoms and the presence or absence of bacteriuria has not been demonstrated" (Walker et al., 2000, p. 276). Walker et al. (2000) also reported that education was an important factor in reducing the number of antibiotics prescribed to patients in long-term care facilities who present with asymptomatic bacteriuria.

In summary, these researchers described why antibiotics were prescribed so often for asymptomatic urinary tract infections through two focused interviews of physicians and nurses. Importantly, both physicians and nurses perceived a change in mental status as a subtle sign that may indicate a urinary tract infection. However, Walker et al. (2000) found no documentation to support that these subtle signs were attributable to a urinary tract infection. More quantitative research must be performed in order to provide empirical evidence which

would validate the relationship between urinary tract infections and mental status changes.

Assantachai, Suwanagool, Gherunpong, and Charoensook (1997) also conducted research on elders with urinary tract infections. Assantachai et al. asserted that the incidence of bacteriuria increases substantially with age and functional disability and further stated that no definitive studies had been completed to assess urinary tract infection in elders. The purpose of the study, therefore, was to predict comorbidity death rates using the clinical manifestations of urinary tract infection.

The researchers utilized a cross-sectional study design to examine a sample of 107 subjects. Subjects included persons aged 60 or older who were admitted to the medical or intensive wards of a major medical school. The sample was divided into two groups: young-old group, aged 60 to 74 years, and old group, aged 75 years or more. Inclusion criteria were 100,000 or more bacteria/ml of urine. Seven of the subjects proved to have asymptomatic bacteriuria; therefore, they were withdrawn from the study, leaving a sample of 100 with urinary tract infections.

The urine was collected by midstream clean catch or from an existing urinary catheter utilizing aseptic technique. The urine was obtained, placed in a

refrigerator at 4 °C, and cultures performed within 24 hours of collection. Estimation of the number of original organisms consisted of multiplying the colony count by 100.

The sample had a mean age of 71.74 ± 8.57 with a range between 60 and 100 years old. The ratio of males to females was 22:78 or 1:3.5. In addition, the ratio of patients admitted to the general medical unit or the intensive care unit was 95:5 or 19:1. Community-acquired infection and nosocomial infection had a ratio of 49:51 or almost 1:1. Immobility prior to infection was found to be 62.6%. Indwelling catheter-related infections compared to non-catheter related infections had a ratio of 46:54 or 1:1.17. The mean duration of indwelling catheterization prior to infection for the nosocomial cases was 37.5 ± 47.38 days. Catheter-related infections were noted in 41.9% of the immobilized cases.

Acute mental status changes were the most common atypical clinical sign with 60% of the participants displaying confusion. In addition, the septic elderly displayed chest symptoms, which may have led the clinician to a false diagnosis of chest infection. Another atypical presentation in the elderly was poor appetite that necessitated nasogastric insertion and resulted in poorer outcomes ($p < .01$). Although pyuria was discovered in 80%

of cases, no significance to the clinical outcome was identified ($p = .286$).

Mortality from infection during the study was 19%, but there was no significant difference in mortality between the cases with and without associated bacteremia ($p = .897$). The mortality rate between those who maintained their mobility and those with immobility was statistically different ($p < .05$). Immobility was more prevalent in the cases ($p = .019$) leading to death, which suggests that clinicians should employ every measure to resume the patient's mobility. Diabetes mellitus was the most common underlying disease with 41% of the participants diagnosed. The number of women with diabetes and bacteriuria was three times the prevalence of bacteriuria in nondiabetic women. Although the mortality rate of participants with diabetes was 41.5%, there was no significant difference when compared with the nondiabetes ($p = .698$). The most serious underlying medical disease was ischemic heart diseases, which was confirmed by the mortality rate of congestive heart failure (69.3%). In addition, the mortality rate for myocardial infarction was 100%.

In summary, the researchers discovered valuable information related to the clinical outcome for patients with comorbid diagnosis. However, the study failed to

analyze the clinical outcome of patients who displayed acute mental status changes. The percentage of those who displayed acute mental status changes was 60%, yet there was no follow-up on their clinical outcome. Also, the initial 7 patients who were dismissed from the study because of a diagnosis of asymptomatic bacteriuria could have been included in the study and assessed for subtle signs of infection such as acute mental status changes. Although these researchers were able to provide the readers with valuable data on clinical outcomes, no statistical significant relationship was established between urinary tract infections and acute mental status changes in elders.

Culp et al. (1997) used a descriptive, longitudinal design with a 14-day follow-up period. Data were collected between March 1, 1995, and June 1, 1995. The sites utilized to gather the data were two Veteran Affairs long-term care (LTC) facilities. Each facility had more than 500 beds and performed their own laboratory analysis. Three nursing units with intermediate and skilled beds were conveniently chosen, and the participants were randomly chosen from the census records of each prospective unit. Inclusion criteria were those age 65 years old or older who could read, speak, and write English. However, those participants with a diagnosis of

depression or other psychiatric disorder, with the exception of a non-recent history of substance abuse and dementia, were excluded.

Culp et al. (1997) utilized a case ascertainment algorithm to identify subjects with acute confusion. The researchers used the Folstein Mini-Mental Status Exam (MMSE) to establish a baseline for detecting a change in mental status. The primary screening instrument was the NEECHAM (range 8 to 30) Confusion Scale because it allowed the researchers to perform rapid bedside assessment of the patient's ability to process information and detect early physiological cues of acute confusion. In two hospital patient samples concurrent validity was established for the NEECHAM using both the MMSE and the diagnostic criteria for delirium. The results displayed a high positive correlation between the NEECHAM and the MMSE, $r = .87$. A correlation with the Barthel Index, $r = .70$, established a construct validity which indicated a link between acute confusional states and the ability to perform activities of daily living. The NEECHAM revealed an interrater reliability of 91% (kappa = .65).

A Confusion Assessment Method (CAM) was used to confirm the NEECHAM screen. Patients were rated on four characteristics using the CAM: acute change in mental status, inattention, disorganized thinking, and altered

level of consciousness. Validity of the CAM was established using a psychiatric evaluation as the gold standard with sensitivity of 94% to 100% and a specificity of 90% to 95% for detecting delirium. The CAM interrater reliability ranged from 84% to 100% (kappa = .65). After the cases were identified utilizing this instrument, the subjects' behaviors were rated using the Vermeersch Clinical Assessment of Confusion scale Form A (CAC-A), which measured the motor symptoms of the confused patients. This assisted in identifying the acute confusion subtype: hypokinetic, hyperkinetic, or mixed (Culp et al., 1997).

To evaluate for changes in cortical functioning indicative of dementia, subjects were evaluated with a clock drawing. A perfect score of 10 was possible with one point being subtracted from 10 for each mistake they made. A score of less than 6 was considered abnormal which displayed a sensitivity of 86.7% and a specificity of 92.7% for detecting dementia. This was validated by comparing the clock drawings of patients with a normal mental status to those with dementia Alzheimer's type (DAT). Content validity for the coding of high-risk medications was conducted by a pharmacist who specialized in geriatric pharmacology by reviewing the individual medication profiles. The pharmacist was blinded to each

individual's score on the acute confusion instrument. Medications which were rated as a high risk were benzodiazepines, H_2 antagonists, beta blockers, antihistamines, and antiemetics (Culp et al., 1997).

Consent to participate in the study was obtained from the subjects when two main points of the information summary were recalled, otherwise a family member gave consent. A registered nurse research assistant obtained the baseline assessment (MMSE, NEECHAM, and clock draw) after attending a 2-day program of instruction and validation of scores rated by the primary investigator.

The research assistant obtained the vital signs and the oxygen-hemoglobin saturations using a noninvasive pulse oximeter. In addition, a color-coded sleep diary was utilized to monitor sleep patterns. The laboratory data, serum electrolytes, complete blood count, urinalysis, and cultures were obtained and performed on-site. Daily NEECHAM measurements were obtained after 5:00 p.m. on four different occasions during the first week of follow-up to detect the evening onset of acute confusion symptoms. Daytime (8:00 a.m. to 5:00 p.m.) assessments were obtained for the remainder of the week. For the second week of follow-up, measurements were obtained every 2 days, alternating between daytime and evening assessments. An MMSE was performed and compared to the baseline score when

the NEECHAM was less than 25. If the MMSE was less than the baseline score, CAM was administered.

In order to estimate the effectiveness of the nurses to recognize acute confusion, the staff nurses were blinded to the scores on a flow sheet utilizing a 3-point ordinal scale (not confused, mildly confused, and confused). A score of mildly confused or confused was considered congruent with the research assistant. The compliance rate for staff nurses completing the ratings every 8 hours was 84% over the 2-week follow-up period.

During the 2-week follow-up period, 37 long-term care residents participated in the study with a prevalence of 40.5% (n = 15) screening positive for acute confusion. Most of the confused patients were 75 years old or older (n = 8, 53.3%). As the age of the subjects decreased, frequencies of acute confusion declined, with the 70- to 74-year-old group (n = 4, 20.7%) and the 65- to 69-year-old group (n = 3, 20%). Those who screened positive for acute confusion did so within the first 6 days with no new cases detected during the second week (Culp et al., 1997).

A list was comprised of the most probable risk factors for each of the acute confusion cases (n = 15). The clock drawing score was listed by each case number for the purpose of defining individuals with subclinical symptoms of dementia. It was discovered that four of the

subjects had a score of < 6 (26.7%) on their clock drawings. More interesting is the fact that three of these patients also had poor oral fluid intake (< 1 liter/day). In most of the subjects more than one condition existed at the time of the acute confusion event (*n* = 15, 86.7%). Several conditions coexisted which included urinary tract infections, which was diagnosed by white blood cells (WBC) in the urine (*n* = 7, 46.7%), high-risk medications (*n* = 7, 46.7%), hypoxia which was diagnosed by a low oxygen-hemoglobin saturation reading (*n* = 6, 40%), pain > 3 on a 1 to 10 scale (*n* = 3, 20%), hypotension as measured by a systolic pressure of < 90 mm Hg (*n* = 3, 26.7%), and hyponatremia (*n* = 2, 13.3%). Several of the subjects displayed an evening onset of acute confusion (*n* = 11, 73.5%) while most of the subjects displayed a restless night prior to the onset of acute confusion as evidenced by less than 6 hours sleep (*n* = 12, 80.0%). The nursing staff detected only four cases of acute confusion (26.7%). All of the cases the nurses detected had hyperkinetic clinical presentations. None of the cases which displayed hypokinetic (*n* = 5, 33.3%) or mixed (*n* = 6, 40.0%) episodes were detected by the nursing staff.

Culp et al. (1997) stated that there was difficulty in comparing estimates of incidence and prevalence across studies because of the variations in instruments used to

detect acute confusion. This, according to Culp et al. (1997), is the reason that overlapping instruments were utilized in this study. Culp et al. further stated that the NEECHAM worked well as a bedside screening instrument while that was not true of the MMSE. According to Culp et al., some of the subjects complained, refused to recall items, or spell backwards which is required on the MMSE. However, at subsequent visits the subjects were more cooperative. In addition, the authors stated that acute confusion is difficult to ascertain in long-term care because delirium has been known to last from weeks to months.

The most common risk variables for acute confusion were urinary tract infections, oxygen-hemoglobin situations below 93%, and high-risk medications. In addition, it was discovered that patients who consumed at least four glasses of water each day experienced a lower risk of acute confusion. Culp et al. further stated that not only does the level of intake establish fluid balance but may also play a role in preventing urinary tract infections which is an antecedent to acute confusion.

A major concern to the authors was the inability of the nursing staff to detect acute confusion. According to Culp et al. (1997), early detection of acute confusion can only happen when bedside care providers are properly

educated about the signs and symptoms of acute confusion. The authors further stated that acute confusion is more than agitated behavior which was the only symptom recognized by the nursing staff in the study. Culp et al. stated that bedside care providers must also learn that subtle signs, such as disruption of the sleep-wake cycle and the inability to remain attentive, are indicative of acute confusion. If traditional confusion assessments are utilized, acute confusion will continue to be under-detected.

In summary, although Culp et al. (1997) discovered some important facts, it cannot be generalized because of the small sample size. However, the fact that almost 50% of the subjects who displayed acute confusion also had a urinary tract infection serves to reiterate the need for more research in this area. In addition, according to Culp et al., laboratory samples were collected once at the beginning of the study. No additional laboratory samples were collected on those patients who displayed acute confusion after the initial laboratory samples had been collected. Culp et al. (1997) further stated that 80% of the subjects displayed a restless night of sleep prior to the acute confusion, yet no laboratory tests were performed to determine if an infection had developed during the study. Finally, there was no mention of any of

the subjects receiving antibiotics for their urinary tract infection to see if the acute confusion resolved. This research only supports the need for further research to be completed on urinary tract infections and mental status changes in elders.

In another research study, Boscia et al. (1986) examined the epidemiology of urinary tract infection in a longitudinal study of an elderly ambulatory population. According to Boscia et al. (1986), the group under investigation consisted of elderly patients (N = 523) who ranged in age from 68 to 103 years with a mean age of 85 years. The sample consisted of 373 women with a mean age of 84.7 years old and 150 men with a mean age of 84.6. In addition, Boscia et al. (1986) stated that the group was homogenous because it was composed of mostly Jewish men and women in the middle and upper classes. The population was stratified by living arrangement: apartment house dwellers and nursing home residents (Boscia et al., 1986). Researchers were permitted to perform an analysis of rates of bacteriuria by functional status, and the subjects needed to be capable of providing a midstream clean-catch urine specimen. The purpose of the study was to determine the patterns of bacteriuria of elders on three surveys performed over an 18-month period assessing the

relationship between functional status and disease (Boscia et al., 1986).

The differences in living arrangements allowed Boscia et al. to calculate rates of bacteriuria among the apartment residents and the nursing home residents. It was this stratification that allowed the researchers to crudely reflect differences in functional status. The participants were assessed by a nurse regarding the ability to dress, comb hair, shave, and feed themselves without assistance. The participants were given an abbreviated mental status examination. Results reflected that 48% of nursing home residents were impaired in activities of daily living compared with a 24.2% of apartment house dwellers ($p < .001$). Sixty-eight percent of nursing home residents had impaired mental status compared with 41.8% of apartment house dwellers ($p < .001$) (Boscia et al., 1986).

The first morning midstream clean-catch urine samples were collected for culturing. After the initial urine was obtained, subsequent first morning midstream clean-catch urine samples were obtained and cultured every 6 months thereafter. The study was conducted between January 1983 and June 1984. Routine cultures were performed on all urine samples. However, if the culture showed growth of 100,000 organisms or more per milliliter, another first

morning midstream clean-catch urine sample was obtained and cultured within one week. The participants were only considered bacteriuric if 100,000 or more per milliliter of the same organisms were discovered on the subsequent culture (Boscia et al., 1986).

The frequency of bacteriuria increased with age, and the rate of increase was almost three times as much for women, compared to men. The female-to-male 3:1 ratio contrast with a 20:1 to 30:1 in younger adults. The researchers discovered that the cumulative percent infected rates rose more rapidly for females than males. "Sixteen percent of women and 5 percent of men were bacteriuric on the first survey. However, by survey 3, the cumulative percent infected on at least one survey was 30 percent of women and 11 percent of men" (Boscia et al., 1986, p. 212). In addition, the researchers indicated that 23.5% of the nursing home residents had positive cultures, while only 12.1% of the apartment house dwellers had positive cultures. Furthermore, Boscia et al. (1986) related that all subjects who were discovered to have impaired activities of daily living or mental status, regardless of place of residence, were more likely to have bacteriuria.

> Thirty-one of 159 (19.5 percent) subjects with an impaired activity of daily living had bacteriuria compared with 46 of 364 (12.6 percent) subjects with

> an intact activity of daily living ($p < .05$). Forty-five of 250 (18.0 percent) subjects with an impaired mental status had bacteriuria compared with 32 of 273 (11.7 percent) subjects with an intact mental status ($p < .05$). (Boscia et al., 1986, p. 210)

In summary, Boscia et al. (1986) indicated that elders with an impaired physical and mental status had a statistically significant higher prevalence of positive urinalysis cultures compared to those whose mental status was intact. In addition, the researchers discovered that positive cultures also increased with age, with women displaying a higher prevalence rate than men. Although this research does support a relationship between mental status and urinary tract infections, it does have its limitations in that the study is dated 1983 to 1984. However, lack of recent research available along with the findings of this study support the need for more research addressing urinary tract infections and mental status changes.

Dontas, Kasviki-Charvati, Chem, Papanayiotou, and Marketos (1981) conducted a longitudinal study on bacteriuria and survival of the elderly. The study population was long-term residents of the Athens House for the Aged. The study was conducted on those residents who were ambulant, had no evidence of kidney disease or obstructive uropathy, and had a fasting blood sugar of

< s7.2 mmol. A sample of 342 residents participated in the study. In addition to the selection criteria, Dontas et al. (1981) had the patients consume the same diet during the study.

Residents who participated provided the researcher with a clean voided midstream specimen at 8:30 a.m., which was cultured immediately. The residents were considered bacteriuric if they had two consecutive positive urine cultures of the same microorganism $\geq$ 80,000 colonies per milliliter within a 2- to 4-month period (Dontas et al., 1981). Residents were considered nonbacteriuric if they had cultures with fewer than 30,000 colonies per milliliter during the same time period. After the initial cultures, the residents were then placed in two different groups (bacteriuric and nonbacteriuric) depending on the results of the cultures. Once a participant was assigned to a group, he or she remained in that group throughout the study regardless of subsequent cultures. The participants were followed clinically through semiannual checkups from the time of the initial urine culture for 10 years or until the participant's death (Dontas et al., 1981).

The participants were stratified by age into 5-year cohorts, sex, and presence or absence of bacteriuria at entry. According to Dontas et al. (1981), "The total study

population was composed of 135 men (19 with bacteriuria) and 207 women (57 with bacteriuria): overall prevalence of bacteriuria was 22.2 percent" (Dontas et al., 1981, p. 940).

The length of survival of the participants was estimated from the date of the first positive or negative culture until the predicted date of death. Two thirds of the subjects died at the institution with the attending physician registering the cause of death. The other residents died at various hospitals where they were admitted for acute episodes of disease. "Data on survival were analyzed according to the life-table method outlined by Peto and Pike, and 95 percent confidence limits in the life tables were computed with the method described by Rothman" (Dontas et al., 1981, p. 940).

According to Dontas et al. (1981), "Life tables and mortality data confirmed the significantly shorter survival of bacteriuric subjects" (p. 941). Dontas et al. further stated, when the bacteriuric women of all ages were treated as one group, 53 deaths were observed at 10 years as compared with an expected value of 30.61: variance = 90.62, $\chi^2(1, N = 76) = 5.29$, $p < .022$. When bacteriuric men were similarly treated, 18 deaths were observed, in comparison with the expected value of 8.02, variance = 26.72, $\chi^2(1, N = 76) = 3.37$, $p < .022$. When the

results for both sexes and all age groups were combined, 71 deaths were observed among bacteriuric subjects, as compared with 38.63 expected, variance = 117.24, $\chi^2(1, N = 76) = 8.66$, $p < .03$. The authors concluded that, "the only factor markedly related to length of survival in their study was bacteriuria" (Dontas et al., 1981, p. 942). The differences between bacteriuric and nonbacteriuric cohorts seemed relatively more important in women (Dontas et al., 1981). According to Dontas et al. (1981), data obtained from their study indicated that in old age, bacteriuria is an important factor associated with a statistically significant reduction in survival in both men and women.

In summary, although this is an old study, data obtained during the study indicated that bacteriuria does have an impact on the survival of the elderly. However, generalization for all elders cannot be made from this study due to the small sample size. The study does bring out the need for more research to be completed on urinary tract infections and elders.

In summary, the review of literature revealed a lack of empirical evidence to support a relationship between urinary tract infections and mental status changes in elders. Additionally, the review of literature informed the readers about the prevalence of confusion in the elderly as well as the impact the burden of the disease

has on society. Although several of the articles confirmed that confusion is a common clinical sign in elders who present with urinary tract infections, there is no empirical evidence which supports a statistical significant relationship between the variables. After reviewing appropriate literature, the purpose of the current study was to perform research which may assist in establishing a significant relationship between urinary tract infections and mental status changes in elders.

Chapter III

The Method

The purpose of this study was to determine whether there is a relationship between urinary tract infections and acute mental status changes among elderly patients in a geriatric-psychiatric unit. This chapter will provide an overview of the methodology utilized to examine the relationship between urinary tract infections and mental status changes in the elder. The reader will be informed of the variables of interest related to the study, and the limitations of the research will be discussed. The methodology of the study, which includes the population, setting, and sample, will be explained in detail. The instrument used in the study will also be defined. Finally, the procedure for collecting data and the methods for analyzing the data will be explained.

Design of the Study

For this study, the descriptive retrospective correlational research method was utilized. A descriptive study is one in which the investigator has no control over the independent variables. "The goal of descriptive

retrospective correlational research is to describe the relationship among variables rather than to infer cause-and-effect relationships" (Polit & Hungler, 1999, p. 196). Data were collected utilizing chart reviews. Therefore, the design was deemed appropriate for this study in which the researcher sought only to describe the relationship between urinary tract infections and mental status changes in elders.

Variables of Interest

The variables of interest for this study were the mental status of the participants as scored on the Mini-Mental Status Exam (MMSE), existence of a urinary tract infection, age of patients, and inpatient treatment at the same geriatric psychiatric facility. Intervening variables included participant's educational level, past life experiences, secondary diagnosis, and the patient's individual medication regimen.

Limitations

Several limitations were identified for this research study. First, the sample was one of convenience which limited application of the findings to the general public. Second, the sample was limited to participants who were inpatients on a geriatric-psychiatric unit which also limited generalization of the results. Additionally,

numerous participants displayed comorbidity which may have had an impact on the MMSE.

Setting, Population, and Sample

The setting chosen by the researcher was the medical records room at a rural southern hospital in Mississippi which treats approximately 65,000 patients annually. The population which the hospital treats represents all socioeconomic, racial, and educational backgrounds.

The target population was all adults age 65 years and older who were admitted to the geriatric psychiatric facility and had a urinalysis report and the MMSE completed during admission. The population consisted of all elders admitted to the facility.

The sample consisted of 100 charts that met the inclusion criteria. Two groups were determined from chart review. The first group consisted of 50 charts of patients age 55 and over who had the MMSE completed during admission and who had a urinary tract infection as established by a positive urine culture with > 30,000 colonies of bacteria, or at least two of the following: nitrates+, leucocytes $\geq$ 2, or bacteria $\geq$ 2. The second group consisted of 50 charts of patients age 55 and over who had the MMSE completed during admission and who had a

negative urinalysis as demonstrated by the absence of nitrates, leucocytes, and bacteria.

Instrumentation

The instrumentation utilized was a chart review flow sheet (see Appendix A). The flow sheet was used to collect and analyze patients' age, gender, and race. In addition, the results of the MMSE and urinalysis were transcribed onto the flow sheet and analyzed using statistical analysis. Results of a urinalysis, which was completed by laboratory personnel at the hospital where the research was conducted, was obtained and results recorded. Collected data included urine white blood cell count, presence or absence of nitrates, presence or absence of blood, and amount and type of bacteria found on culture and sensitivity test.

Data Collection Procedure

Prior to implementation of the study, permission was obtained from the Committee on Use of Human Subjects in Experimentation from Mississippi University for Women (see Appendix B) and the Institutional Review Board of North Mississippi Medical Center (see Appendix C). The research was conducted utilizing chart reviews in the medical records room of a rural southern hospital. All charts which met the inclusion criteria were reviewed and

appropriate data collected until the sample of 100 charts was obtained. Two groups of charts were obtained from the chart review. Results of the urinalysis and scores of the MMSE were recorded and analyzed.

The procedure for selecting the charts for the study was accomplished according to the following. Each individual who was admitted to the geriatric unit had name, diagnosis, and medical record number listed in a register book. From this book, the patient's medical record numbers were copied. They were then placed in a locked briefcase and carried to the medical records room. Once inside the medical records department, the briefcase was unlocked and the medical record numbers were given to the medical records clerk who pulled the appropriate charts (corresponding with the medical records numbers) and placed them on desk where the researcher was working. As each chart was located, the medical records clerk would draw a line through the appropriate medical record number to ensure that it was not retrieved again. The researcher then studied the charts and separated those that met the inclusion criteria from those that did not meet the criteria. After compiling several charts that met the inclusion criteria, the researcher transcribed the pertinent data onto the flow sheet designed for this study. This procedure was repeated until the set number of

charts with the inclusion criteria was obtained for each group.

Method of Data Analysis

Demographic data were analyzed and reported using descriptive statistics, including frequency distributions and percentages. A *t* test then was performed to analyze the difference between the mean MMSE scores of the two groups.

Chapter IV

The Findings

The purpose of this study was to determine whether there was a relationship between urinary tract infections and acute mental status changes among elderly patients with a urinary tract infection in a geriatric-psychiatric unit. Using a retrospective design, this researcher performed chart reviews to collect data. Data were subjected to descriptive statistical analysis. This chapter contains a description of the sample and findings related to the research hypothesis.

Description of the Sample

The target population was all patients who were admitted to the geriatric psychiatric unit at a southern rural hospital. The actual sample consisted of 100 elderly patients' charts from the geriatric psychiatry unit. The sample was comprised of two groups: Group 1 consisted of 50 subjects who met the inclusion criteria and did not have a urinary tract infection, while Group 2 consisted of 50 subjects who also met the inclusion criteria but did

have a urinary tract infection according to preestablished criteria.

Analysis of each group individually revealed that for Group 1 the range of age for the patients was 60 to 89 years, with a mean of 75.08 years. In Group 1, females represented 66% of the sample (n = 33) and males represented 34% (n = 17). Racial representation of Group 1 was 28% African American (n = 14) and 72% Caucasian (n = 36). Analysis of race and gender revealed 8% African American males (n = 4), 20% African American females (n = 10), 26% Caucasian males (n = 13), and 46% Caucasian females (n = 23) in Group 1. In addition, the participants of Group 1 were categorized into specific age descriptors for interpretation of frequency and percentages and are summarized in Table 1.

Table 1

Age Descriptors of the Sample by Frequency and Percentage in Group 1

Age (years)	f[a]	%
55 to 64	9	18.0
65 to 74	15	30.0
75 to 84	15	30.0

(*table continues*)

Table 1 (*continued*)

Age (years)	*f*[a]	%
85 to 94	11	22.0
≥ 95	0	0.0

Note. Percentages were rounded to the nearest tenth.
[a]*n* = 50.

Analysis of Group 2 revealed that the range of ages for the patients were 56 to 95 with a mean age of 77.7 years. Females represented 76% of the sample (*n* = 38) and males represented 24% (*n* = 12). Racial representation of Group 2 was African American 24% (*n* = 12) and Caucasian 76% (*n* = 6) of the sample, while African American females composed 12% (*n* = 6), Caucasian males, 18% (*n* = 9), and Caucasian females, 58% (*n* = 29) in Group 2. In addition, the participants of Group 2 were categorized into specific age descriptors for interpretation of frequency and percentages. These are summarized in Table 2.

Table 2

Age descriptors of the Sample by Frequency and Percentage in Group 2

Age (years)	*f*[a]	%
55 to 64	3	6.0
65 to 74	11	22.0
75 to 84	25	50.0
85 to 94	10	20.0
$\geq$ 95	1	2.0

Note. Percentages were rounded to the nearest tenth.

[a]$n = 50$.

Data gathered on the chart review flow sheet indicated a combined mean age of 76.4 years. Participants of the combined groups were categorized into specific age descriptors for interpretation of frequency and percentages and are summarized in Table 3.

Table 3

Age Descriptors of the Sample by Frequency and Percentage in Combined Groups

Age (years)	*f*[a]	%
55 to 64	12	12.0
65 to 74	26	26.0
75 to 84	40	40.0
85 to 94	21	21.0
$\geq$ 95	1	1.0

[a]$N = 100$.

Comparison of the mean age of both groups revealed no statistical significant difference between the ages of the groups, $t = -1.536$, $p = .127$.

All subjects who were accepted into Group 2 met the preestablished criteria for having a urinary tract infection. Data from the culture and sensitivity test revealed the pathogens by organism and percentage and are summarized in Table 4.

Table 4

Culture Pathogens by Organism and Percentage in Group 2

Causative organism	%
Escherichia coli	40.0
Enterococcus faecalis	20.0
Proteus Mirabilis	10.0
No growth	16.0
Culture not performed	14.0

Note. n = 50. Percentages were rounded to the nearest tenth.

Cultures which had no growth or those on which no culture was performed displayed at least two of the following criteria for a urinary tract infection: positive for nitrates, leucocytes $\geq$, or bacteria $\geq$.

Results of Data Analysis

The research hypothesis for this study was as follows: There will be no statistically significant difference in the mental status of elders with urinary tract infection and elders without urinary tract infection.

Analysis of each group individually revealed that for Group 1, the MMSE yielded ranges from 0 to 26, with a mean

score of 21.3. Analysis of the MMSE data from Group 2 revealed a range from 0 to 30, with a mean score on the MMSE of 17.3.

A *t* test for independent samples was conducted to compare the mean scores between the two groups. Results showed that there was a statistically significant difference in mean MMSE scores between the two groups, $t = -3.458$, $p = .001$. Therefore, patients without a urinary tract infection scored significantly higher than those with a urinary tract infection. The researcher rejected the null hypothesis for the study.

Summary

Chapter IV included the sample as well as the data collection and analysis for the study. Data obtained from the chart review flow sheet were described and analyzed descriptively to answer the research hypothesis of whether there is a difference in the mental status of elders with a urinary tract infection and the mental status of elders without a urinary tract infection. Findings revealed a statistically significant lower mean score on the MMSE in elders who had a urinary tract infection compared to the MMSE scores of elders who did not have a urinary tract infection, and the research hypothesis was rejected. In Chapter V outcomes of the findings will be presented,

including discussion, conclusions, implications, and recommendations for nursing science.

Chapter V

The Outcomes

An explanation of the findings of this study in relation to the research problem is summarized and discussed in this chapter. Conclusions are drawn, implications for nursing are examined, and recommendations for nursing science are made.

Elderly patients sometimes present with atypical symptoms of a urinary tract infection, such as acute mental status changes, rather than the typical symptoms of urgency, frequency, and dysuria. The relationship between mental status changes and infection, such as pneumonia, has been presented in the literature; however, research relating to mental status changes and urinary tract infection is limited. This descriptive study examined the relationship between mental status changes and urinary tract infection in elders. The null hypothesis that guided the study stated that there would be no statistically significant difference in the mental status of elders with a urinary tract infection and elders without a urinary tract infection. Data were collected using a retrospective

chart audit utilizing a researcher-developed demographic flow sheet. Neuman's Health Systems Model provided the theoretical framework for the study.

Summary and Discussion of Findings

The sample consisted of 100 participants' charts (50 with a urinary tract infection and 50 without a urinary tract infection). The ages of the participants with a urinary tract infection ranged from 56 to 95 years, and participants without a urinary tract infection ranged from 60 to 89 years. The mean age of participants with a urinary tract infection was 77.7, and participants without a urinary tract infection had a mean age of 75.08. The sample consisted of 68 females and 32 males who were admitted to the behavioral health unit at a rural southeastern hospital.

Demographic findings of this research study were similar to Boscia et al.'s (1986) findings in which there was a female-to-male 3:1 ratio for patients who had a urinary tract infection. Ethnicity of the sample included 74 Caucasian and 26 African American participants. This researcher sought to examine the mental status of the two groups by comparing the scores on the Mini-Mental Status Exam (MMSE). A *t* test was used to report differences in the scores on the MMSE. Participants who had a urinary

tract infection had statistically significant lower scores on the MMSE compared to participants who did not have a urinary tract infection ($p < .001$). Therefore, the researcher failed to accept the null hypothesis.

The results of this study indicated significantly lower MMSE scores among elders who presented to a geriatric psychiatric unit with a urinary tract infection compared to elders who did not have a urinary tract infection. Although no studies were found in the review of literature to support this finding, this researcher believes that urinary tract infections may have impacted the scores on the MMSE. Walker et al. (2000) stated that the physicians and nurses described subtle indicators of a urinary tract infection as an increase in confusion, irritability, and subtle personality changes. However, "an association between these nonspecific signs and symptoms and the presence or absence of bacteriuria has not been demonstrated" (Walker et al., 2000, p. 276).

This current researcher has determined, through experience as a registered nurse on a behavioral health unit, that many elderly patients who present with a change in mental status were being referred to a psychiatrist or being admitted to a behavioral health unit before ruling out an infection as an underlying cause.

In addition, this researcher determined that elders sometimes display subtle signs of a urinary tract infection such as confusion rather than typical signs such as urgency, frequency, and dysuria. Assantachai et al. (1997) discovered that mental status changes were the most common atypical clinical sign of a urinary tract infection with 60% of the participants displaying confusion. However, Assantachai et al. (1997) stated that no definitive studies had been completed to assess urinary tract infection in elders.

Conclusions

The researcher determined that urinary tract infections did have a relationship on the mental status of elders as evidenced by a significant decrease in scores on the MMSE in patients who had a urinary tract infection. However, these findings must be interpreted with caution since other factors, such as comorbidity and individual medication regimens, could possibly affect mental status.

More research is needed to establish empirical evidence of a relationship between urinary tract infections and mental status. Primary care providers can assist in this endeavor by performing routine urinalysis on elders. By performing routine urinalysis on elders, complications of urinary tract infections, such as mental

status changes, may be prevented. In addition, routine urinalysis may prevent inappropriate hospitalizations by early diagnosis and treatment of urinary tract infections.

Implications for Nursing

This research study was conducted to examine the relationship between mental status changes and urinary tract infections in the elder. Knowledge of a relationship between mental status changes and urinary tract infections will assist the advanced practice nurse to more accurately assess, diagnose, and promptly treat mental status changes in the elder. Implications were suggested for the areas of education, practice, administration, theory, and research. These implications would be utilized to provide a higher quality of patient care.

Nursing education. Results of this study contributed to the existing body of nursing knowledge regarding the effects of urinary tract infection on the mental status of elders. As the elderly population increases, it is essential that nurse practitioners be prepared to respond to the special needs of patients who present with mental status changes. The findings of this study indicated to the researcher that urinary tract infections might have an adverse effect on the mental status. Education of nursing students should include information regarding the subtle

changes which may be indicative of a urinary tract infection in the elder. Advanced practice nursing programs need to enhance curricula to include appropriate administration of the MMSE and when to perform routine or diagnostic urinalysis. The health care risks for these patients can be decreased or prevented if the provider is aware of the detrimental effects of urinary tract infections.

Nursing practice. In providing care to elders, nurse practitioners must be aware of the impact of urinary tract infections on mental status changes. Nurse practitioners could apply the results of this study to better utilize the MMSE as a screening tool. The nurse practitioner could more accurately assess, diagnose, and provide prompt treatment if mental status changes associated with urinary tract infections were discovered on screening in primary care settings instead of after inappropriate hospitalization has occurred. In addition, being aware of the negative effects of urinary tract infections would assist nurse practitioners in implementing anticipatory measures to prevent falls and injuries in elders.

To keep costs down, nurse practitioners must be aware of the effects that urinary tract infections and mental status changes have on the patient, caregiver, and community. Accurate diagnosis and treatment of patients

who present with a change in mental status are imperative to prevent escalating costs to the patient, caregiver, and community.

Nursing theory. The current researcher effectively utilized the Neuman Systems Model as a theoretical framework. The concept of the individual being an open system in constant interaction with the environment and, therefore, affected by both external and internal factors which can cause stress were validated. Neuman identified three aspects of the environment: internal, external, and created. Internal environment is intrapersonal or within the client. A urinary tract infection is part of the client's internal environment since it occurs within the client. Based on this model, mental status changes are also primary internal changes. When using Neuman's Health Systems Model to guide practice, the nurse practitioner can utilize the theory to assist the patient in strengthening the lines of defense to maintain a state of wellness.

Nursing research. Minimal recent empirical data exist regarding mental status changes and urinary tract infections in the elder. Findings from this study help to bridge the gap regarding the effect of urinary tract infections on mental status. Due to paucity of recent literature, additional research studies are needed to

determine the effects of urinary tract infections on mental status changes. The findings from such research could impact the care of patients who present with urinary tract infection and mental status changes. The outcomes of this study should be explicated in the professional literature.

Recommendations for Further Study

The following recommendations were made based on the results of the current study and the limitations that were identified in the study:

1. Replication of a similar study with a larger sample in various geographic locations to evaluate the effects of urinary tract infection on mental status.

2. Implementation of a longitudinal study with a larger sample in various geographic locations which includes treatment for the urinary tract infection with the MMSE and urinalysis performed before and after treatment.

3. Replication of a similar study utilizing randomized groups with a larger sample in various geographic locations.

4. Replication of a similar study which utilizes controls for comorbidity and medication regimens.

Summary

In this chapter, the study was summarized and the analysis of data was reported. Conclusions from the study were made and reported to the reader. In addition, implications for nursing and nursing education were described. Future utilization of the theory which guided this study was elaborated on. The researcher explored avenues in nursing research which should be performed in order to discover empirical evidence which would support the current research. Finally, recommendations for future research were suggested.

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APPENDIX A

DEMOGRAPHIC CHART
REVIEW FLOW SHEET

Demographic Chart Review Flow Sheet

Age	Race	Gender	MMSE	WBC	Nitrate	Blood	C & S	Bacteria

APPENDIX B

APPROVAL OF MISSISSIPPI UNIVERSITY FOR WOMEN'S COMMITTEE ON USE OF HUMAN SUBJECTS IN EXPERIMENTATION

MISSISSIPPI UNIVERSITY FOR WOMEN

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December 19, 2001

Ms. Arland Jones
c/o Graduate Nursing Program
P. O. Box W-910
Campus

Dear Ms. Jones:

I am pleased to inform you that the members of the Committee on Human Subjects in Experimentation have approved your proposed research with the following stipulation: a consent form must be executed in writing by the facility prior to the implementation of the research.

The committee reminds you that the results of any questionnaire or survey must be kept under lock and key to ensure confidentiality and be kept for a sufficient length of time to protect the participant and the researcher.

I wish you much success in your research.

Sincerely,

Vagn K. Hansen, Ph.D.
Provost and Vice President
for Academic Affairs

VH:wr

cc: Mr. Jim Davidson
Dr. Patsy Smyth
Dr. Sheila Adams

APPENDIX C

APPROVAL OF THE INSTITUTIONAL REVIEW BOARD OF NORTH MISSISSIPPI HEALTH SERVICES

NORTH MISSISSIPPI
HEALTH SERVICES

INSTITUTIONAL REVIEW BOARD

February 22, 2002

Mr. Arland Dale Jones, RN, BSN
19 CR 330A
Corinth, MS 38834

Dear Ms. Jones:

The Institutional Review Board has received your request to review the following:

Title: Relationship Between Mental Status and Urinary Tract Infections in Elders

The IRB approved the above via expedited review for one year. All of the files associated with this study will be kept in the appropriate IRB file.

Sincerely,

Ken Davis, M.D.
Chairman

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